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(54) **EARBUDS WITH BIOMETRIC SENSING**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,715,321 A 2/1998 Andrea et al.
8,121,325 B2 * 2/2012 Atamaniuk H04M 1/05 381/322
8,600,096 B2 12/2013 Lin
8,611,578 B2 12/2013 Kim et al.
8,873,786 B2 10/2014 Larsen et al.
8,879,722 B1 11/2014 Wang et al.
9,161,114 B2 10/2015 Bone et al.
9,344,792 B2 5/2016 Rundle
9,398,364 B2 7/2016 Monahan et al.
9,438,300 B1 9/2016 Oliaei et al.
(Continued)

FOREIGN PATENT DOCUMENTS

KR 1020100001360 1/2010
WO 2014116924 7/2014

OTHER PUBLICATIONS

U.S. Appl. No. 14/856,344 , "First Action Interview Pilot Program Pre-Interview Communication", Nov. 9, 2016, 5 pages.
(Continued)

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(57) **ABSTRACT**

This application relates to earbuds configured with one or more biometric sensors. At least one of the biometric sensors is configured to be pressed up against a portion of the tragus for making biometric measurements. In some embodiments, the housing of the earbud can be symmetric so that the earbud can be worn interchangeably in either a left or a right ear of a user. In such an embodiment, the earbud can include a sensor and circuitry configured to determine and alter operation of the earbud in accordance to which ear the earbud is determined to be positioned within.

8 Claims, 15 Drawing Sheets